PICARD sol

Ground component mission PICARD
Cooperation between OCA and LATMOS

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Rational

- During the last 40 years, solar diameter measurements from ground have been performed. In particular, F. Laclare started in 1975 a series of radius measurements at Calern (Observatoire de la Côte d'Azur).
- These observations showed various evolutions of the solar diameter at time scale of the 11-year solar cycle.
- The origin of these variations is unclear. It may be due to the observer, the atmosphere (turbulence) or the sun itself..
- If a correlation between the solar diameter and the solar activity is proved, it may serve as a proxy to reconstruct the evolution of the past solar irradiance for climate modelling.
- Solar diameter can be derived from observations during solar eclipses since the 18th century.
- Simultaneous measurements from space and from ground using the same instrument could allow to separate the atmospheric effect from the true solar variation.

PICARD sol scientific objectives

•To understand the influence of the atmosphere on solar diameter measurement

•To explain the solar limb shape observed from ground

•To compare solar diameter measurement form space (SODISM) and from ground (SODISM-2) for separation of atmospheric effects and true solar variability

•Balloon-borne measurements using SODISM-3 or SDS may serve as an alternative of SODISM space measurements if the anomaly problem is not solve

•To compare SODISM-2 measurements with other ground-based instrumental series to link with historical series of solar diameter.

•To evaluate the feasibility to monitor the solar diameter from ground.

SODISM-2 at Calern

Instruments

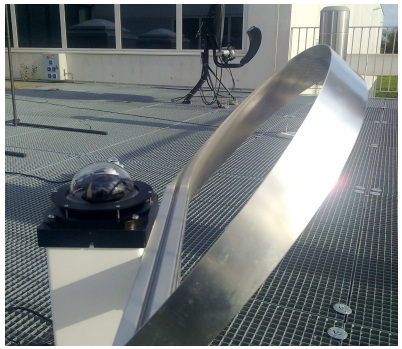
-Telescope imager SODISM-2

-Turbulence monitor MISOLFA

-Automated photometer

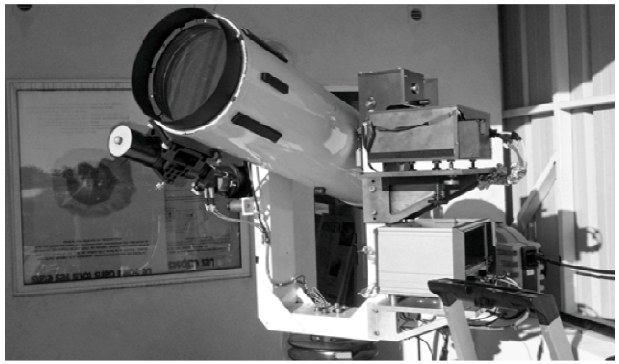
-Pyranometer

-Large field of view camera

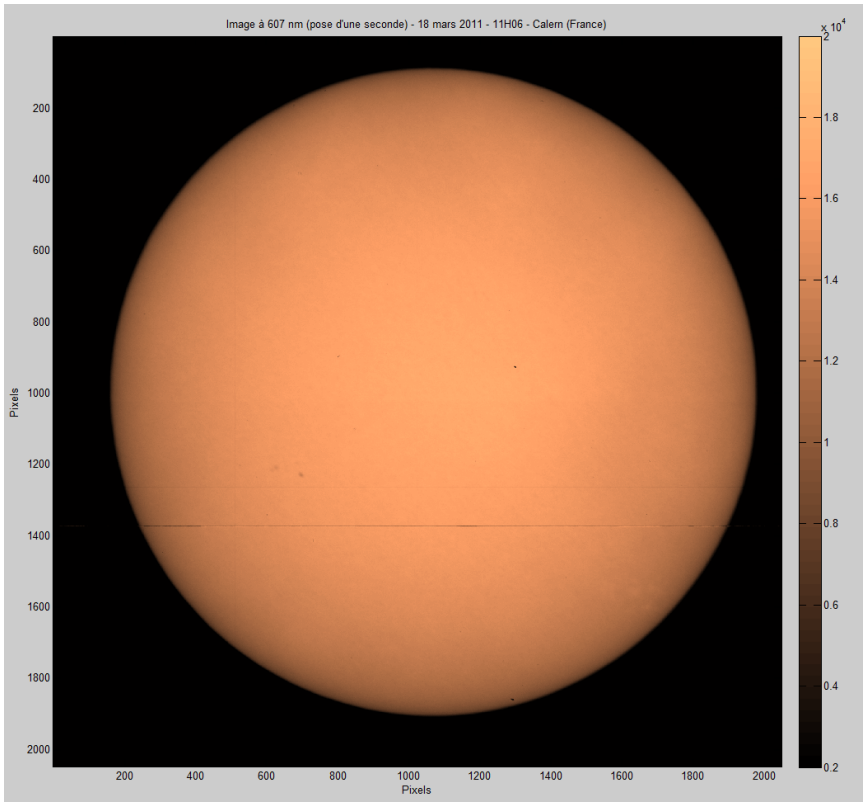


SODISM-2

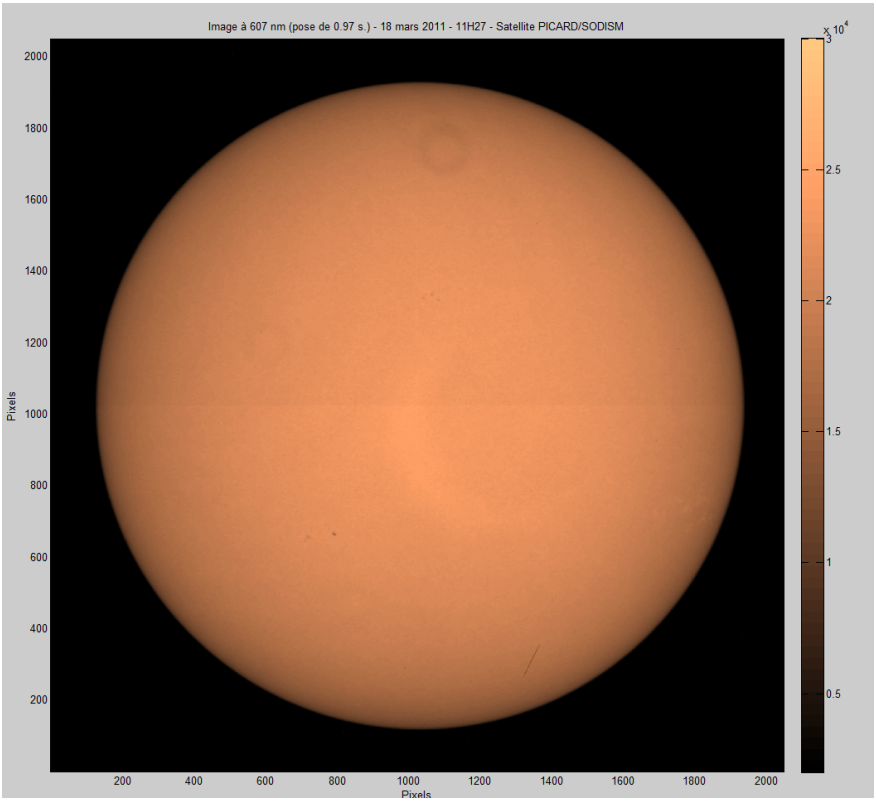
MISOLFA Turbulence monitor



First results (1/4)
First image



SODISM-2 Image 607 nm – 18 March 2011, Calern

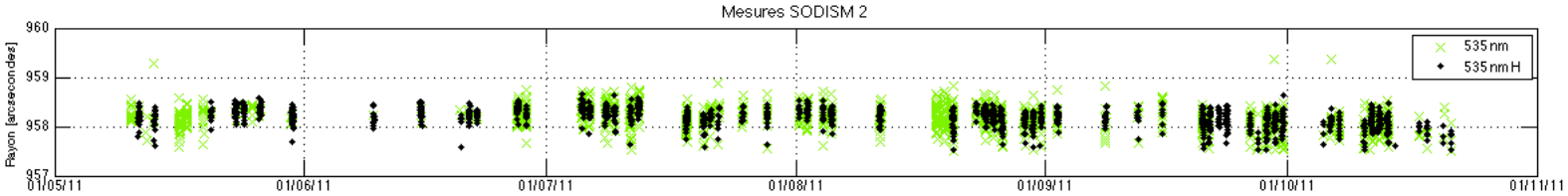


SODISM Image 607 nm – 18 March 2011, space

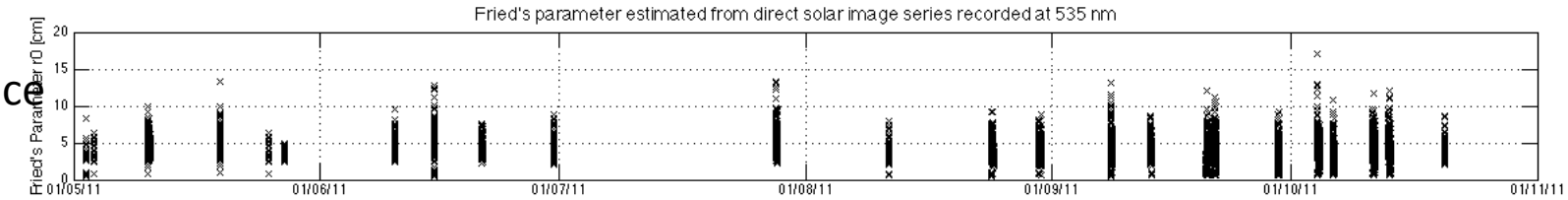
First results (2/4)
Evolution of the parameters

Measurements : SODISM II, MISOLFA, Photometer and Pyranometer Pyranometer

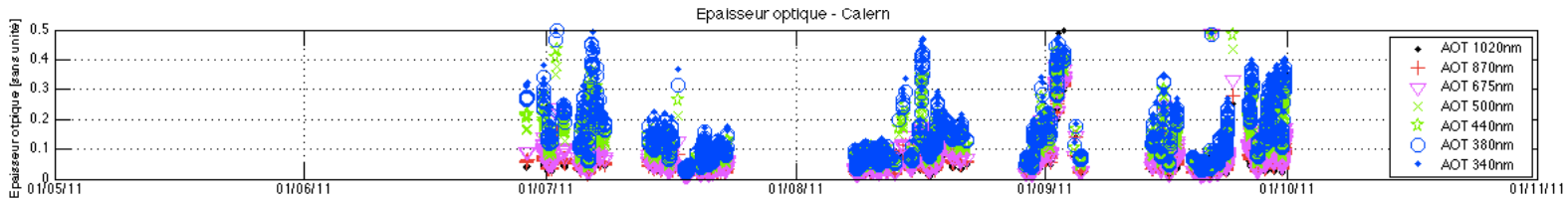
Solar radius



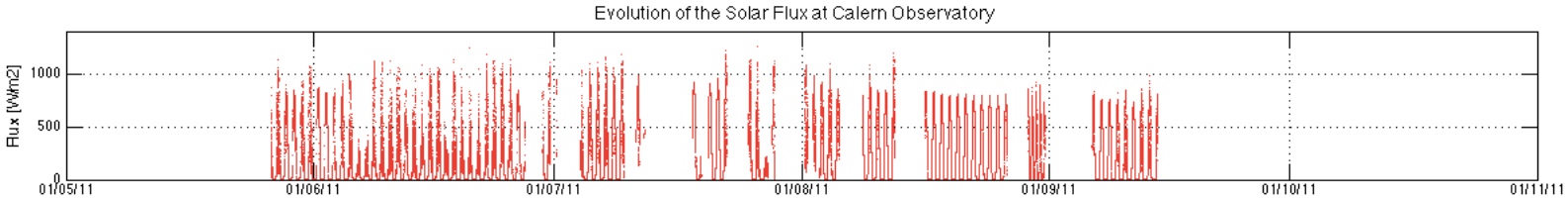
Turbulence



Aerosols



Solar flux



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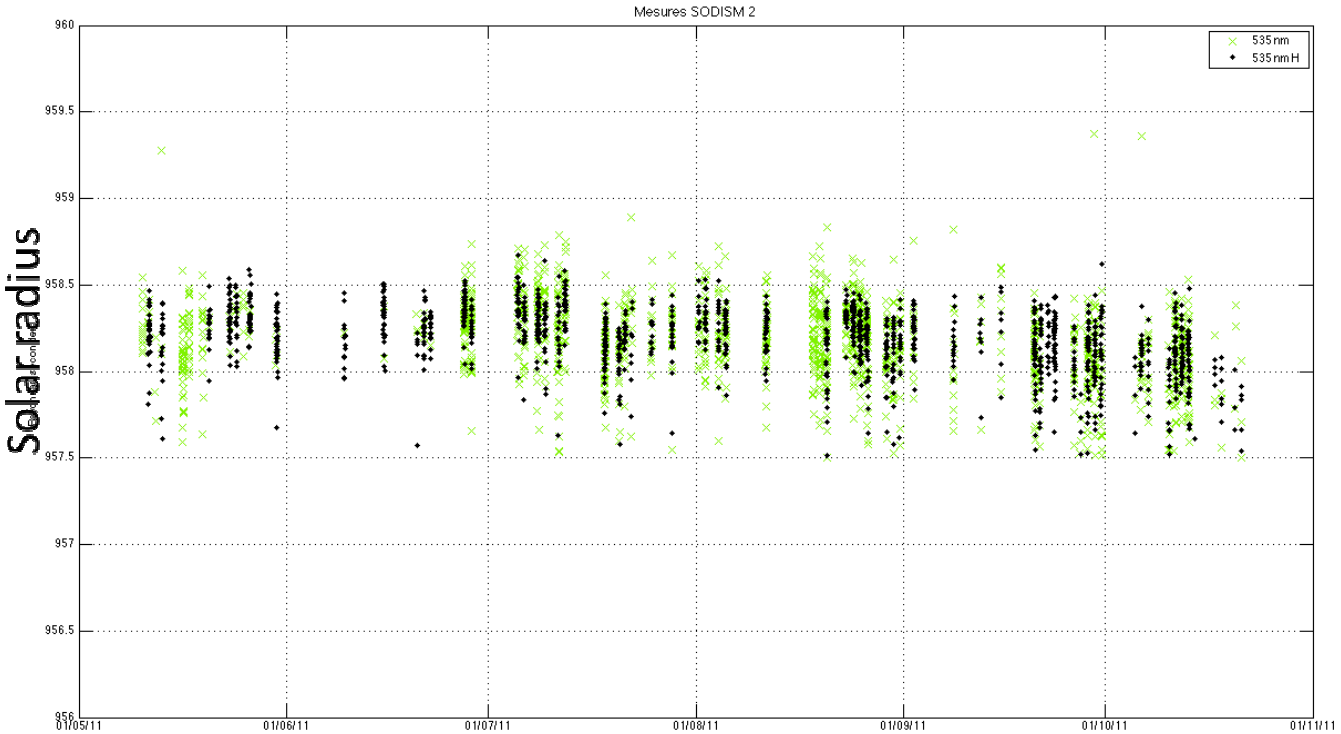
è The atmospheric turbulence (Fried parameter r0) seems to be the main effect

First results (3/4)
Effect of turbulence

Solar diameter evolution at 535 nm (D and H)



r0 (cm)	DR (rayon)
1	773 mas
2	651 mas
3	405 mas
4	262 mas
5	173 mas
6	112 mas
7	74 mas

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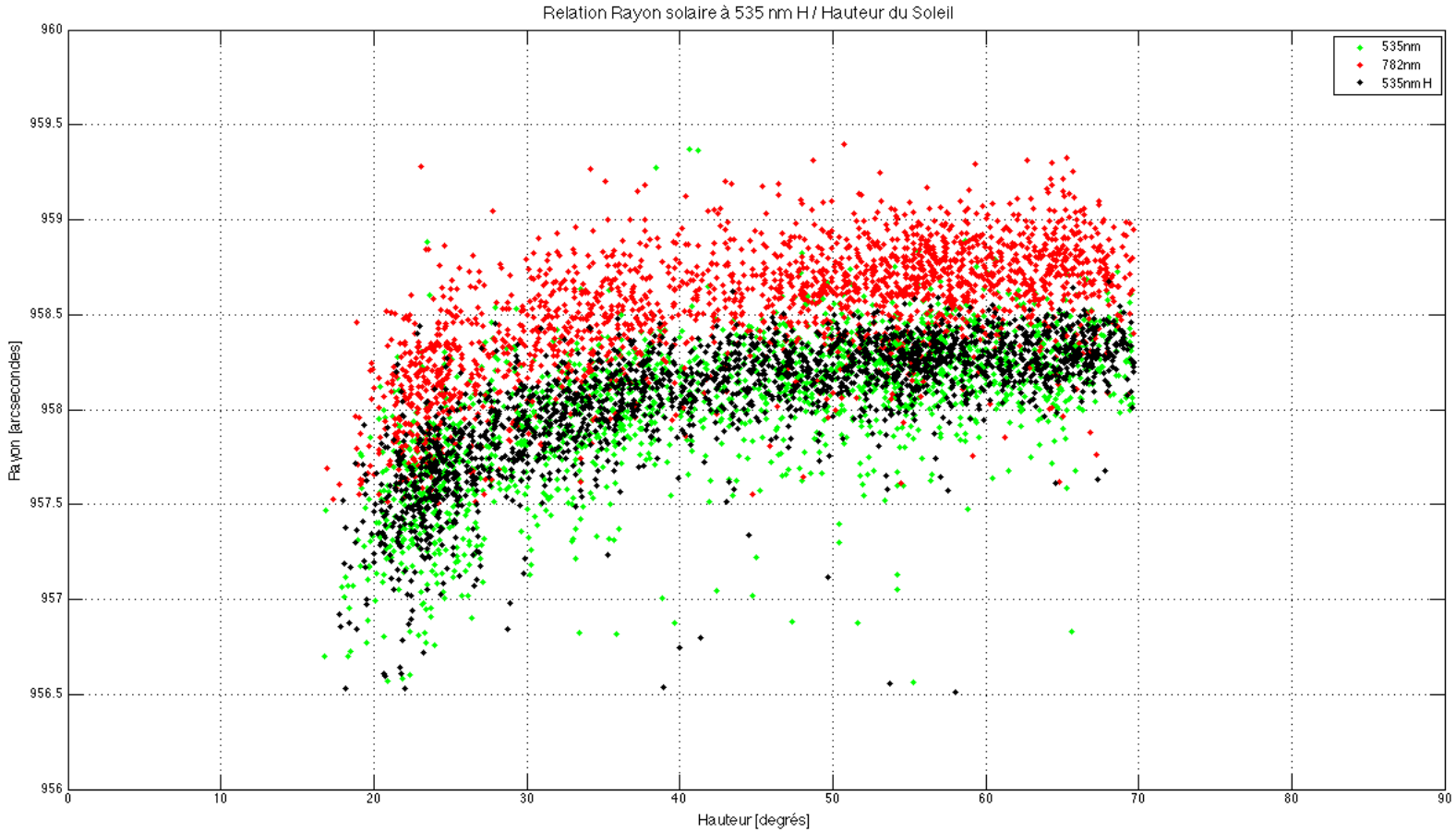
è When the atmospheric turbulence increases (r0 → 0), the solar radius decreases (displacement of the inflexion point). During one day , the radius may vary by 1000 mas depending on the turbulence (simplified model).

First results (4/4)



Solar radius

Solar elevation

Conclusion

- Preliminary results seem to indicate a good long term stability of SODISM-2 diameter measurements at ground but with a short term variability of up to 1000 mas peak to peak
- The main observed effect in the observed variability is the atmospheric turbulence
- The final accuracy of ground based measurements after atmospheric effect correction is still to be determined